

REMARKS

Claim Rejections

The Examiner has made all of the same claim rejections as in the previous Office Action, and these rejections were based on the same reasoning and verbatim language as in the previous Office Action. Although Applicant still disagrees with the rejections and the reasons for the rejections, Applicant will not further argue against those rejections/reasons in this paper. Instead, in an effort to advance this case toward allowance, Applicant has amended the claims in a way that renders the Examiner's rejections/reasons moot. Consequently, Applicant will not repeat the same Examiner reasoning herein. Applicant submits that all of the claims, as amended herein, are patentable over the prior art of record.

Rejections Under 35 U.S.C. 102

The Examiner has again rejected claims 19, 21 and 23-28 under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,857,057, with inventors of Nelson et al. (hereinafter "Nelson").

Rejections Under 35 U.S.C. 103

The Examiner has again rejected claims 1-13, 15-18, 20 and 22 under 35 U.S.C. 103(a) as being unpatentable over Nelson in view of U.S. Patent Application No. 2004/0010654, with inventors of Yasuda et al. (hereinafter "Yasuda").

The Examiner has again rejected claim 14 under 35 U.S.C. 103(a) as being unpatentable over Nelson in view of Yasuda, and further in view of U.S. Patent No. 5,778,418, with inventors of Auclair et al. (hereinafter "Auclair").

Arguments Concerning Prior Art Rejections

The Examiner addressed arguments from Applicant's response to the prior Office

Action as follows:

1st Point of Argument

Regarding claims 1, 19, 20, 22 and 23, the applicant argues that Nelson fails to teach, "saving substantially all of the device state of the VM to a checkpoint data store". However, Nelson teaches saving state of the primary VM to secondary VM via snapshot operation in Figure 3, wherein the secondary VM corresponds to the "checkpoint data store" from the claim.

2nd Point of Argument

Regarding claims 1, 19, 20, 22 and 23, the applicant further argues that Nelson fails to teach, "marking the set of VM memory as copy-on-write (COW)". The applicant supports his/her argument by stating the memory disclosed in Figure 1 of Nelson cannot be considered as a "VM memory". However, the claim defines a "VM" as a "virtual machine". Since Nelson teaches virtual disks ("virtual machine") and the cited "Memory" acts as a temporary storage area for the disks (Column 4, Lines 20-21), the cited "Memory" corresponds to the "VM memory" from the claim. Further, the examiner considers the snapshot operation between the virtual disks as the claimed "copy-on-write" operation, wherein the "memory" provides a temporary storage area for the virtual disks.

The applicant further argues that Nelson fails to teach, "allowing the VM to continue using the VM memory". However, Nelson teaches the system accessing the "memory" in Figure 3. The examiner suggests the applicant to be more specific regarding the limitation, "using" the VM memory.

3rd Point of Argument

Regarding independent claims 19 and 23, the applicant further argues that Nelson fails to teach, "responding to memory COW faults related to the VM memory by generating copies of the original VM memory for read and write use by the VM".

However, Nelson clearly teaches generating snapshots of the original virtual disk in column 1, at lines 37-39. If any faults occur to the original disk, the system responds by recovering the original disk by using the snapshot disk file.

4th Point of Argument

Regarding claims 3 and 23, the applicant argues that Nelson fails to teach, "allowing the VM to execute during at least a part of the time during which the checkpoint is being generated". However, Nelson teaches transferring the data saved in the temporary memory to "storage space 14 in Figure 1. The examiner suggests the applicant to be more specific regarding what the VM is actually executing.

The applicant further argues that Nelson fails to teach, "ensuring that the results of any pending disk writes are applied to both the checkpointed virtual disk and the ongoing virtual disk" and "that the results of any pending disk reads are applied to both the checkpointed VM memory and the ongoing VM memory". The applicant supports his/her argument by stating that the examiner's citation has nothing to do with "pending disk writes/reads", as that phrase is used in the instant application. The applicant supports his/her arguments regarding claim 3 by stating the same reason. However, Nelson clearly teaches "pending disk writes/reads" in the temporary memory in Figure 1, wherein the contents of the memory are transferred to/from disks.

The applicant further argues that Nelson fails to teach, "that the results of any new disk reads are applied to the ongoing VM memory, but not to the checkpointed VM memory". The applicant supports his/her argument by stating that the examiner's citation has nothing to do with either ongoing VM memory or checkpointed VM memory.

However, Nelson teaches reading the new data that is the results of the "First Write" (49, Figure 3), which is only stored in the original virtual disk ("ongoing VM memory").

5th Point of Argument

Regarding claim 25, the applicant argues that Nelson fails to teach the recited claim limitations. However, Nelson teaches reading the data saved in the cache, wherein the data is restored by the snapshot storage device in column 4, at lines 20-23.

The applicant states that the cited reference has nothing to do with reissued disk reads. However, the examiner kindly requests the applicant to explain how the claimed "reissuing" is patentably distinct from the cited issuing disk reads after data restoration.

6th Point of Argument

Regarding claims 15 and 26, the applicant argues that Nelson fails to teach the recited claim limitation. The applicant supports his/her argument by stating that the examiners citation has nothing to do with forcing COW faults for original VM memory.

However, the examiner interprets the claim as fixing/recovering faults associated for the VM memory, which Nelson clearly teaches in column 4, lines 20-23. The examiner suggests the applicant to be more specific regarding the term "forcing".

7th Point of Argument

Regarding claims 18 and 28, the applicant argues that the examiner's citation from Nelson has nothing to do with the claim limitation. However, the cited data restoration results in the claimed data write delay.

8th Point of Argument

Regarding claims 1, 20 and 22, the applicant argues, "Yasuda et al. has nothing to do with stopping a VM". However, Yasuda et al. teaches stopping operation in a virtual network in paragraph 84.

The applicant further argues that the cited references fail to teach, "handling memory COW faults to the original VM memory to generate copies of the original VM memory for read and writ use by the VM". The applicant supports his/her argument by stating that the "storage space 14" does not correspond to the claimed "VM memory".

However, the "storage space 14" is a virtual RAID snapshot system (Figure 3, Column 3).

9th Point of Argument

Regarding claim 8, Nelson discloses a snapshot operation (Column 4, Lines 20-23), wherein the contents of the original disk must be read prior to copying the contents to the snapshot disk.

10th Point of Argument

Regarding claims 16 and 17, applicant argues that the examiner's citation has nothing to do with the claimed limitation. However, the examiner suggests the applicant to specify what the "resumption of the operation" is since the examiner interprets the operation as any operations following/preceding the pending disk operations.

Applicant appreciates the suggestions from the Examiner. As can be seen from the amendments to the claims indicated above, Applicant has followed some of these suggestions.

Applicant respectfully submits that claims 1, 19 and 23, as amended herein, are patentable over the prior art of record. Applicant submits that the prior art references cited by the Examiner, considered in combination or separately, do not disclose nor suggest at least the following limitations:

For claim 1:

- (1) saving substantially all of the device state of the VM, including an instruction pointer, a plurality of registers and settings for one or more virtual devices, to memory,
- (2) resuming operation of the VM, so that the VM reads from and writes to the COW disk file and so that the VM reads from, writes to, and executes code from the VM memory,
- (3) handling memory COW faults to the original VM memory to generate copies of the original VM memory for read, write, and execution use by the VM, and
- (4) wherein the VM memory is a subset of a physical memory in the virtual computer system, the VM memory being a portion of the physical memory that is allocated to the VM;

For claim 19:

- (1) saving substantially all of the device state of the VM, including an instruction pointer, a plurality of registers and settings for one or more virtual devices, at the time for which the checkpoint is generated, to a checkpoint data store,
- (2) allowing the VM to continue reading from, writing to, and executing code from the VM memory,
- (3) responding to memory COW faults related to the VM memory by generating copies of the original VM memory for read, write, and execution use by the VM, and

- (4) wherein the VM memory is a subset of a physical memory in the virtual computer system, the VM memory being a portion of the physical memory that is allocated to the VM; and

For claim 23:

- (1) saving substantially all of the device state of the VM, including an instruction pointer, a plurality of registers and settings for one or more virtual devices, at the time for which the checkpoint is generated, to a checkpoint data store,
- (2) saving the contents of the VM memory, at the time for which the checkpoint is generated, to the checkpoint data store, and allowing the VM to continue using reading from, writing to, and executing code from the VM memory,
- (3) allowing the VM to execute, including executing code from the VM memory, during at least a part of the time during which the checkpoint is being generated, and
- (4) wherein the VM memory is a subset of a physical memory in the virtual computer system, the VM memory being a portion of the physical memory that is allocated to the VM.

Each of the dependent claims contains all of the limitations of its respective independent claim. Consequently, each of the dependent claims is patentable over the cited prior art for at least the same reasons as its respective independent claim.


Conclusion

The various embodiments of the applicant's invention as defined in the various independent claims recite features that are not found at all in any of the cited references, whether the references are viewed independently or in combination. Accordingly, applicant submits that the independent claims are allowable over the cited prior art. The various dependent claims, of course, simply add additional limitations and should therefore be allowable along with their respective independent base claims. Applicant requests reconsideration of this application.

Date: 22 February 2008

Respectfully submitted,

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